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NRR DPR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 Allendale Road
King of Prussia, PA 19406

B Miller Comments

MEMORANDUM TO: ~~John Jolicoeur~~Robert A. Nelson, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Darrell J. Roberts, Director
Division of Reactor Projects

SUBJECT: REQUEST FOR TECHNICAL ASSISTANCE
SEABROOK STATION ALKALI-SILICA REACTION

Region I requests technical assistance from the Office of Nuclear Reactor Regulation (NRR) to evaluate the consequence of alkali-silica reaction (ASR) degradation of safety related concrete structures at Seabrook Station, and to evaluate the impact of the degradation on the current licensing and design basis.

Background

NextEra (the licensee) analyzed concrete core samples from the interior surface of exterior walls of the Control Building as part of their assessment to support renewal of their license. In August 2010, tests~~,~~ undertaken as a part of the core sample analysis~~,~~ reported a change in material properties. The analysis reported the presence of ~~alkali-silica reaction (~~ASR~~)~~ in core samples taken from chronically wet walls below grade, with apparent reductions reported in the concrete compressive strength and modulus of elasticity. NextEra evaluated these parametric reductions to determine the impact on the design basis of the Control Building. The licensee performed an operability determination and concluded that the Control Building was within the limits of the design basis although with reduced margins. NextEra continues to evaluate the extent of this condition.

NextEra's planned actions follow the guidance in NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," to develop an aging management program to support the license renewal application. Their proposal is described in ~~their~~ a letter ~~of~~ dated April 14, 2011, ~~in~~ under the response to ~~an~~ NRC request for additional information B.2.1.31-1 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML111~~0~~08A131). The proposal includes another analysis (termed "final" by NextEra)~~ analysis~~ of the impact of ASR on the current licensing and design basis, including the extent of the condition, to be completed during June 2011.

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With respect to Part 50 requirements, Region I reviewed the NextEra current Structures Monitoring Program and found a violation of the maintenance rule for the control building. The finding is described in detail in NRC Inspection Report 05000443/2011002 (~~ml~~ADAMS Accession No. ML111330689). More details related to the newly discovered ASR issue ~~is~~are also documented in NRC Inspection Report ~~No.~~ 05000443/2011007 (~~ml~~ADAMS Accession No. ML111360432), which was issued as ~~a~~ part of ~~the~~ a license renewal inspection ~~report~~. The cover letter for ~~this~~ the latter report notes that the aging management review for the ASR issue is not complete and that there is a need for a continuing review in the Part 50 and 54 areas. The staffs of Region I and NRR (Division of Engineering and License Renewal) have been working closely together to ensure the agency reviews this matter in unison.

Region I ~~needs~~ requests the assistance of NRR in reviewing various NextEra documents/evaluations that have already been completed, and NRR assistance will also be requested in the future to review documents/evaluations that NextEra plans to issue ~~to be issued from~~ between now ~~until~~ and March 2012 (tentative schedule) as they become available. Therefore, Region I expects that this TIA request will be the first in a series of TIA requests related to ASR degradation at Seabrook. Both the completed and planned documents/evaluations are as follows:
~~as noted in the licensee's position section below.~~

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~~Licensee Position~~

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~~NextEra has conducted a number of evaluations of ASR affected structures. Their actions are centered around taking core samples of the concrete and conducting various tests for compressive strength and modulus of elasticity on those unconfined samples. The primary actions to date or planned are:~~

A. Prompt Operability Determination for the Control Building (AR 581434 available by "certrec" website) based on compressive strength and modulus of elasticity testing. Petrographic examination was also conducted confirming the presence of ASR in the core samples. (Completed on XX/XX/XXXX)

Comment [BWM1]: Acronym? Action Request?

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B. Design Change No. EC-272057, Concrete Modulus of Elasticity for the Control Building Electrical Tunnel and the Containment Enclosure Building (available by certrec~~x~~ website), referring to AR Nos. 581434 and ~~AR~~ 1644074 which accepts the reduction in ~~the~~ modulus of elasticity in light of concrete core testing using a 10 CFR 50.59 screening process. (Completed on XX/XX/XXXX)

C. "Final" Operability Determination including a~~A~~dditional core sampling on five other buildings with less severe evidence of ASR. ~~Operability Determination will be available~~ (Expected on or about June 30, 2011)~~.~~

Comment [BWM2]: I'd suggest we either wait to submit this TIA until this OD is complete or not include it in the scope of this TIA.

~~D.~~ Engineering Evaluation ~~scheduled for March 2012~~ which completes the aging management review and ~~it~~ is anticipated ~~that it will not only~~to address the proposed aging management program for license renewal ~~but~~ and also provide recommended changes in the current Structures Monitoring Program for all Maintenance Rule in-scope buildings affected by ASR. (Scheduled for March 2012)

D.

Within the limitations of their testing, NextEra has determined that ~~'s testing to date has not resulted in~~none of the seismic category I structures tested to date (the control building and containment enclosure building) have been found to be ~~being~~ outside their design basis ~~(control building and containment enclosure building)~~.

The Seabrook design and licensing bases to which the licensee has made these determinations is documented in UFSAR Section X.X, "..." which states, "..."

~~Region I Preliminary Inspector Views/Observations~~

~~Based on staff interactions to date related to this issue a number of questions have arisen:~~

Based on the review of the ASR issue to date, the Region I staff believes that NRR should also consider the following information during this TIA review.

- Because the original design basis assumes no ASR is present during the design life of the structure, it is not clear how ASR affects the original design assumptions or calculational methods, such as the relationship between compressive strength and modulus of elasticity to shear capacity and shear force used in the seismic analysis. For example, the assumed relationship between compressive strength and tensile strength may not be valid with ASR present.
  - ~~We agree with headquarter staff who have raised a questions in this area. What remains unknown is how much of an effect does the ASR have on this validity (some research may be needed).~~

- ~~A preliminary analysis by NextEra focuses on the effect of ASR on the foundation's response to design loads. It is not clear this approach, in the final analysis, would be adequate. Should we insist the final analysis include the response of the whole building with ASR present in the foundation?~~

- ~~What is the extent, duration, and timing of actions that NextEra should take to address the problem of immediate operability, and maintenance of the design basis response? In other words, how long do we wait and under what criteria do we have for research to be developed in order to address key questions related to operability and compliance with the current licensing and design basis.~~

- ~~It should be noted that no~~No tensile strength testing is being performed on the concrete core samples ~~and it is an issue raised by headquarters staff. With respect to the question of tensile strength reduction in concrete, the inspector's view is~~However, the Region I staff believe that tensile strength ~~it~~ is not relevant in a constrained structure after the ASR pressure load is transferred to the rebar. Using ~~the~~ ASTM XXXX ~~standard proposed by NRR~~, the reported tensile values ~~reported~~ can vary from ~~the~~ real values by up to ±40% and, as one researcher said, "~~...~~ ~~/st~~ can hardly be assumed to be a material property~~."~~[1] ." Prior to transfer, the pressure contribution appears to be minimal (on the order of less than 5% of the rebar yield based on preliminary research of literature).

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Comment [BWM3]: Unless the design and licensing bases are extremely long, include them here. At a minimum, cite the regulatory documents and sections that contain the design and licensing bases information.

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Comment [BWM4]: This is addressed under #5 in the "Requested Actions" below.

Comment [BWM5]: This is fundamentally an inspection/enforcement question, which is the Region's lead responsibility. However, NRR's review of the adequacy of the Operability Determination should inform this decision. In other words, the Region should be able to answer this once the TIA review is complete.

Also, is "operability" the right word here? Aren't we really talking about an unanalyzed condition since the design basis never accounted for ASR? If it's an "operability" question, then what LCO would be entered if found inoperable? Would the reportability criteria under 50.72 and 50.73 be more appropriate?

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- A core sample with ASR does not represent the forces contained in the structure because for this test, in particular, rebound is not considered and frictional influences in the test itself are not accommodated. ~~As a matter of fact the~~The frictional losses are exacerbated by the standard laboratory practice of placing plywood on opposing faces of the tensile specimen to stop it from rolling off the test stand, thus restraining axial expansion of the sample.

- Design Change No. EC-272057~~Preliminarily the design change~~ had a 50.59 review which screened out. ~~In light of the newly discovered issue, one would think that, as a minimum, an~~The Region I staff believes that a 50.59 evaluation ~~w~~should have been conducted ~~in order~~ to determine if ~~there is an unreviewed safety question~~the design change should have been submitted for NRC review.

1."Review of the splitting-test standards from a fracture mechanics point of view", C. Rocco, G. V. Guinea, J. Planas, and M. Elices, Facultad de Ingeniería, Universidad Nacional de la Plata, La Plata, Argentina, Departamento de Ciencia de Materiales, Universidad Politécnica de Madrid, Madrid, Spain, 5 September 2000

Requested Actions

~~In light of the questions above,~~ Region I ~~needs~~ requests the assistance of NRR/~~DE in conjunction with the Division of License Renewal and as applicable the Office of Research in order to~~ in evaluating~~e the below listed areas for~~the following documents to determine if they provide reasonable assurance of continued operability given the concrete degradation identified due to ASR. Where applicable, Region I requests that NRR identify where regulatory requirements may not have been met.

A. Prompt Operability Determination for the Control Building. (Completed on XX/XX/XXXX)

B. Design Change No. EC-272057, Concrete Modulus of Elasticity for the Control Building Electrical Tunnel and the Containment Enclosure Building. (Completed on XX/XX/XXXX)

~~the above noted NextEra operability determination and design changes or other evaluations that may support these reviews such as detailed calculations or computer code work.~~ If NRR finds that either or both of the above documents do not provide reasonable assurance of continued operability, Region I requests that NRR identify the basis of their concerns. Specifically, Region I requests that NRR identify any concerns with the assumptions, methodologies, or calculations, etc., related to items 1 through 6 below for each of the documents listed above. ~~For each of the area, our regulatory basis should be clearly identified:~~

1. Adequacy of concrete core sampling (locations, numbers, frequency of sampling in the future, etc).

2. Completeness of the laboratory testing of core sampling including appropriate parameters obtained along with laboratory test conditions ~~for now and in the future~~.

3. Need for and completeness of any *in situ* testing of building conditions ~~-~~including appropriate parameters obtained along with test conditions for now and in the future. As

Comment [BWM6]: Which test?

Comment [BWM7]: 50.59 doesn't use this terminology anymore.

Comment [BWM8]: Is this really a question that the Region is asking NRR to answer? If so, it needs to go in the "Requested Actions" section, and our 50.59 HQ reviewer always asks that the region does the following before putting a 50.59 question in a TIA:

(1) Obtain a copy of the licensee document that explains why they didn't do an evaluation (which is probably their 50.59 screening document.)

(2) Review this 50.59 screening document against NEI 06-07, rev. 1. You need to describe potential problems by quoting specific excerpts from the NEI 96-07, rev.1 along with a description of how the licensee did not meet the guidance.

(3) Discuss potential problems that you identify with the licensee to see if they agree or if they can provide you an explanation you agree with.

(4) A 50.59 TIA question would only be needed if you disagree with the licensee regarding whether they were consistent with the quoted excerpts from NEI 96-07, rev 1 that you would include in your 50.59 TIA question.

Comment [BWM9]: A TIA review may recognize a need to interface with RES, but any formal assistance from RES would have to be initiated through a process separate from the TIA agreement btwn Region I and NRR. This would likely be in the form of a User Need request.

Comment [BWM10]: I added these words (obviously), but isn't this really the big picture question that Region I wants answered?

In other words, when you get the TIA response from NRR, what do you want the overall conclusion to get at? Is it reasonable assurance? Compliance with regulations? Both? Neither?

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an example, where and how much rebar should be exposed in order to assess the effect on rebar from the ASR issue.

4. Assessment of the effect of the alkali-silica reaction degradation on the current and future ability of safety structures to respond to design basis loads, including seismic ~~response~~events.

5. Adequacy of ~~an~~ the analysis of the foundations alone vs. the response of ~~the~~ a whole structure when the foundation is degraded.

~~6. From the analysis done above, review the a~~Adequacy of the structures monitoring program ~~for necessary changes in light of~~given the ASR issue.

~~6. In the longer term on or about March 2012, Region I needs the same assistance as noted above when NextEra completes and Engineering Evaluation which should complete the aging management review for license renewal but more importantly, recommendations are anticipated with respect to changes to the existing structures monitoring program to meet the maintenance rule up to the license expiration date. We request NRR review for adequacy of the additional monitoring and mitigation strategies proposed by NextEra in light of the newly discovered ASR issue.~~

Comment [BWM11]: Should this be a stand-alone question?

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Coordination

This request was discussed between Richard Conte and Michael Modes (RI/~~DRS/EB1~~), and Meena Khanna, George Thomas, and Barry Miller (NRR/~~DE/EMCB~~) during a ~~various~~ conference call~~s~~ on 6/17/2011 ~~the subject of ASR at Seabrook~~. The TIA was accepted with an agreed upon response date within ~~90~~ XX days after receipt, ~~of the NextEra Engineering Evaluation completed during March 2012.~~

References

http://portal.nrc.gov/edo/ri/EB1/Shared%20Documents/Forms/AllItems.aspx

Docket No. 50-443

~~J. Jolicoeur~~R. Nelson 6

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